Insect Vectors

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Natural History

- Studies throughout the world have shown that many cases of human illness are caused by zoonotic pathogens that are maintained by animal hosts in their natural cycles.
- Many zoonoses require a vector (e.g., mosquito, tick, mite) to be transmitted from the animal host to the human host.
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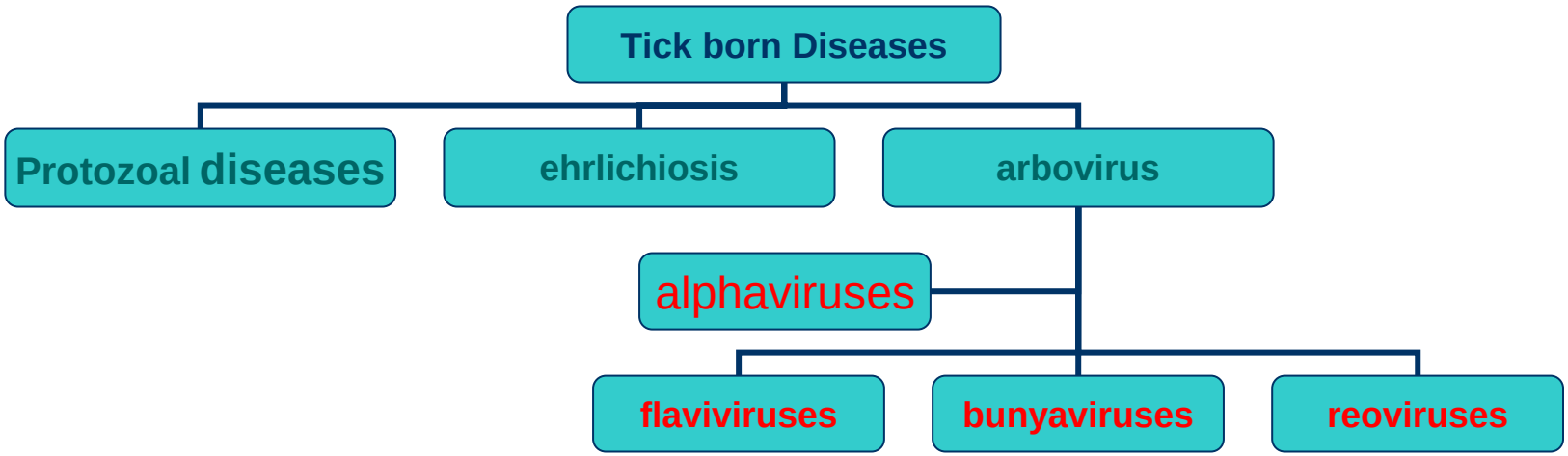
The tick born disease cycle includes four components:

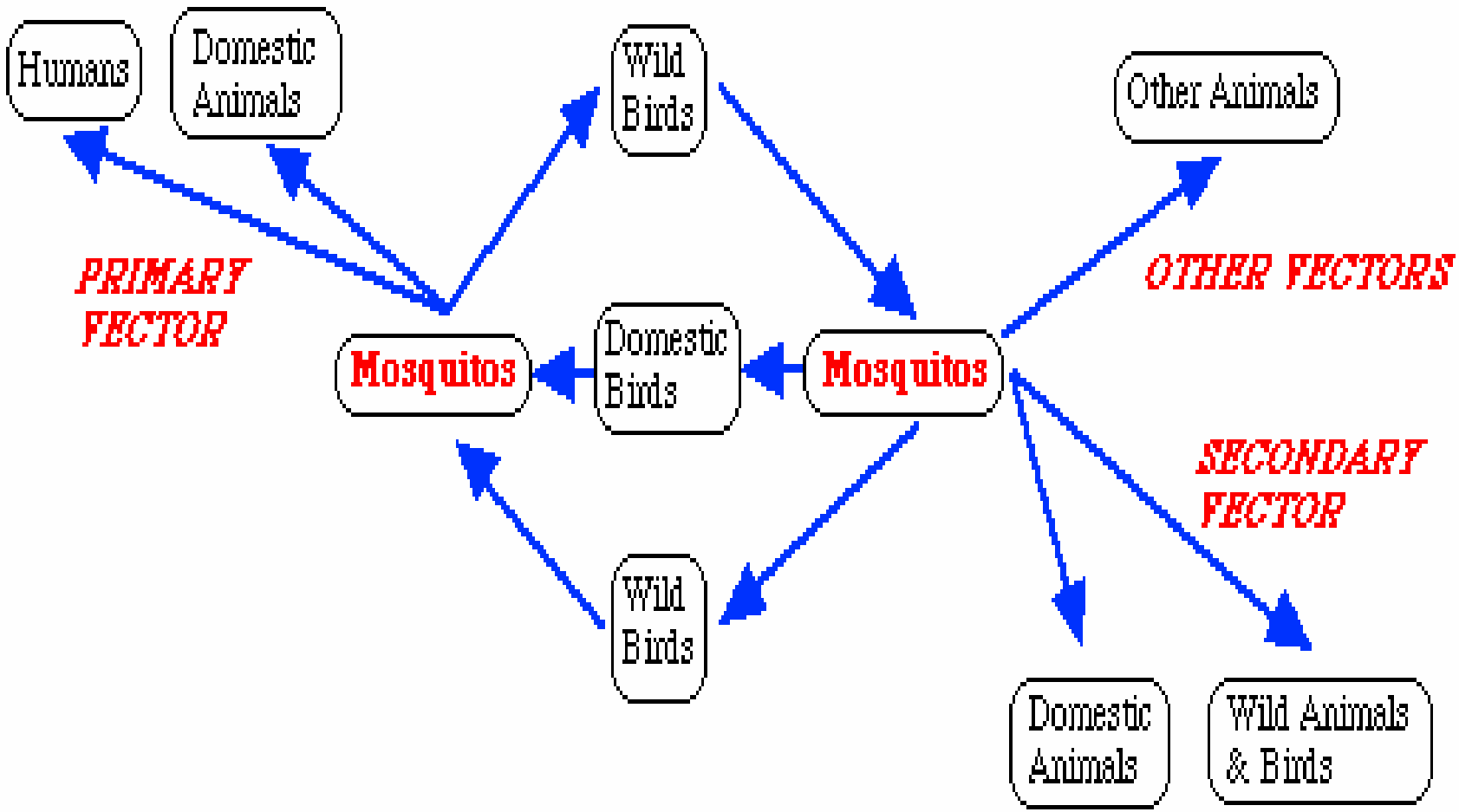
- the pathogen,
- the animal reservoir species,
- the vectors, (vectors like ticks).
- and the human host.

Tick born Disease Diagram



What is an arbovirus?

- Arboviruses (arthropod-borne viruses) are a large group of viruses that are spread mainly by blood-sucking insects.
- Birds are often the source of infection for mosquitoes, which can then spread the infection to other animals, and people.


Humans
Domestic Animals
Wild Birds
Other Animals
PRIMARY FECTOR
OTHER FECTORS
Mosquitos
Domestic Birds
Mosquitos
SECONDARY FECTOR
Wild Birds
Domestic Animals
Wild Animals & Birds

- Centers for Disease Controland Prevention
- Components in the Transmission and Maintenance of Arboviral Encephalitis
- Components in the Transmission and Maintenance of Arboviral Encephalitis
- Encephalitis

- arboviruses can cause serious and potentially fatal inflammation of the brain (encephalitis) as well as other complications.

- Prevention depends mainly on public health action to control mosquitoes and on individual action to avoid mosquito bites.

What are arbovirus infections?

- Illnesses of the central nervous system, ranging in seriousness from mild viral meningitis[1] to encephalitis (inflammation of the brain), with coma, paralysis, and death
- Mild fever illnesses with or without rash
- Hemorrhagic fevers that can be serious and life-threatening
- Arthritis[2] and rash[3], with or without fever

1: brain 2:joint infection 3: skin inflammation

What are some important arbovirus infections?

- More than 100 arboviruses cause disease in humans. Most of these are classified into groups, or families. Among the best known are: alphaviruses, flaviviruses, bunyaviruses, and reoviruses. Each causes specific types of illness.

Alphaviruses

- Eastern Equine encephalitis
- Western Equine encephalitis
- Venezuelan equine encephalitis

Flaviviruses

- St. Louis encephalitis
- Japanese encephalitis
- Yellow fever
- Dengue

Bunyaviruses

- LaCrosse encephalitis
- Reoviruses
- Colorado tick fever

How common are arbovirus infections?

- Because people are not important in the life cycle of most arboviruses, arbovirus infections are generally rare in humans.
- When people are part of the natural cycle and are necessary for transmitting infection, such as for dengue and urban yellow fever viruses, then infection in people is more common.
- Most cases of arboviral encephalitis occur in summer season

How can arbovirus infections be prevented?

- Prevention centers mainly on public health action to control mosquitoes and on individual action to avoid mosquito bites. Community mosquito-control programs can reduce mosquito populations by applying pesticides and draining standing water.
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What is ehrlichiosis?

- Ehrlichiosis is the general name used to describe several bacterial diseases that affect animals and humans. These diseases are caused by the organisms in the genus *Ehrlichia*. Worldwide, there are currently four ehrlichial species that are known to cause disease in humans.

How do people get ehrlichiosis?

- ehrlichiae are transmitted by the bite of an infected tick. The lone star tick (*Amblyomma americanum*), the blacklegged tick (*Ixodes scapularis*), and the western blacklegged tick (*Ixodes pacificus*) are known vectors of ehrlichiosis in the United States. *Ixodes ricinus* is the primary vector in Europe

What are the symptoms of ehrlichiosis

- The symptoms of ehrlichiosis may resemble symptoms of various other infectious and non-infectious diseases. These clinical features generally include fever, headache, fatigue, and muscle aches. Other signs and symptoms may include nausea, vomiting, diarrhea, cough, joint pains, confusion, and occasionally rash. Symptoms typically appear after an incubation period of 5-10 days following the tick bite. It is possible that many individuals who become infected with ehrlichiae do not become ill or they develop only very mild symptoms.

where do most cases of ehrlichiosis occur?

- Most cases of ehrlichiosis are reported within the geographic distribution of the vector ticks . Occasionally, cases are reported from areas outside the distribution of the tick vector. In most instances, these cases have involved persons who traveled to areas where the diseases are endemic, and who had been bitten by an infected tick and developed symptoms after returning home. Therefore, if you traveled to an ehrlichiosis-endemic area 2 weeks prior to becoming ill, you should tell your doctor where you traveled.

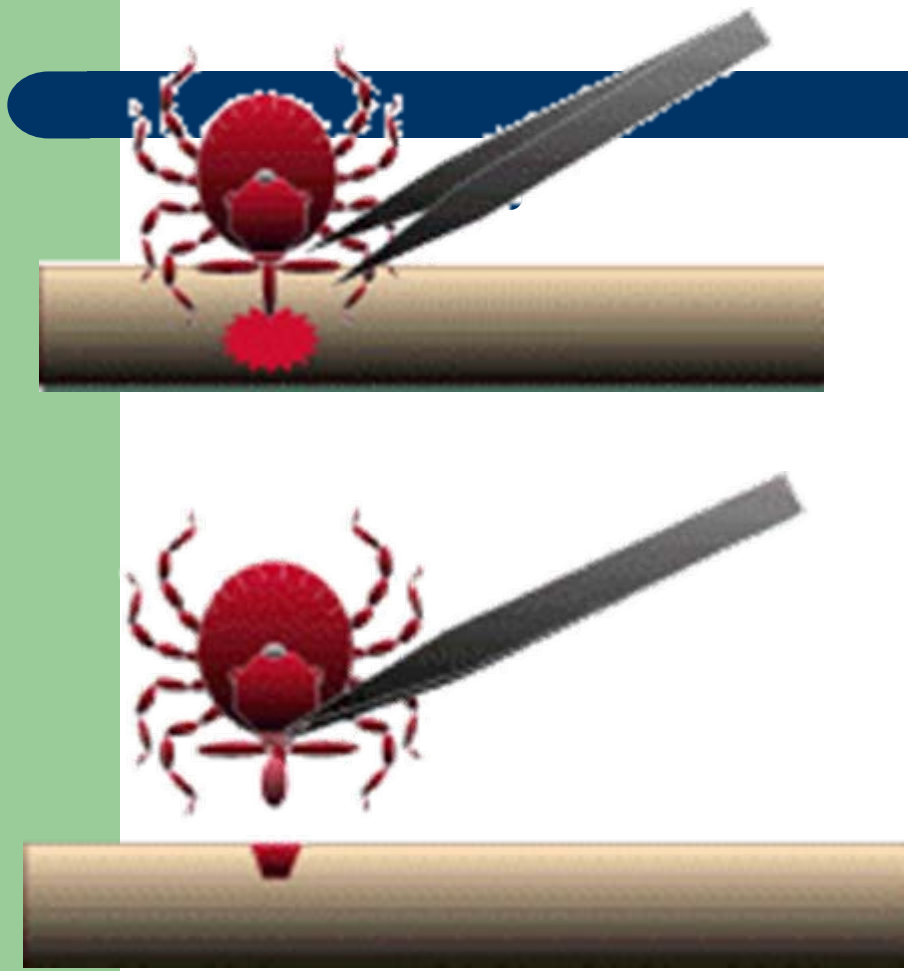
How can ehrlichiosis be prevented?

- Limiting exposure to ticks reduces the likelihood of infection in persons exposed to tick-infested habitats.
- It is unreasonable to assume that a person can completely eliminate activities that may result in tick exposure. Therefore, prevention measures should be aimed at personal protection:

measures for personal protection

- Wear light-colored clothing-- this will allow you to see ticks that are crawling on your clothing.
- Tuck your pants legs into your socks so that ticks cannot crawl up the inside of your pants legs.
- Apply repellants to discourage tick attachment

What is the best way to remove a tick?



:1. Use fine-tipped tweezers or shield your fingers with a tissue, paper towel, or rubber gloves.

- 2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin.

How can ticks be controlled?

- Strategies to reduce vector tick densities through area-wide application of acaricides (chemicals that will kill ticks and mites) and control of tick habitats (e.g., leaf litter and brush) have been effective in small-scale trials.
- New methods under development include applying acaricides by using baited tubes, in areas where these pathogens are endemic.
- Biological control with fungi, parasitic nematodes, and parasitic wasps may play important roles in integrated tick control efforts.
- Community-based integrated tick management strategies may prove to be an effective public health response to reduce the incidence of tick-borne infections. However, limiting exposure to ticks is presently the most effective method of prevention.
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Western blacklegged tick (*Ixodes pacificus*)

Lone star tick
(*Aml*

Blacklegged tick

- What about Animals

The following diseases are included within the category of multiple species diseases:

- Anthrax
- Aujeszky's disease
- Echinococcosis/hydatidosis
- Heartwater
- Leptospirosis
- Q fever
- Rabies
- Paratuberculosis
- New world screwworm (Cochliomyia hominivorax)
- Old world screwworm (Chrysomya bezziana)
- Trichinellosis
- Foot and mouth disease
- Vesicular stomatitis
- Lumpy skin disease
- Bluetongue
- Rift Valley fever.